



# Mobile health in Sierra Leone: Evidence and implications for health systems



Technical Brief  
December 2014



Government of  
Sierra Leone



Medical Research Centre



University of  
Sierra Leone



Mannion Daniels



## mHealth in Sierra Leone

Sierra Leone has taken important steps over the last decade towards improving the health status of its people; the launch of the Free Healthcare Initiative (FHCI) in 2010 was a major milestone that made healthcare services available free of charge for pregnant and lactating women and children under five years. But the current maternal and newborn health statistics illustrate that the health system still faces challenges.

There is a need to increase demand, improve healthcare provision, and facilitate the connection between communities and healthcare providers. These challenges and the need for stronger involvement of communities and better communication between these and health workers came even more to the forefront during the current Ebola crisis.

Mobile communication technologies are rapidly spreading globally and Africa is no exception. It is an opportune time to use this technology development as a platform for public health interventions. But the evidence for how best to use mobile communication technology for health (called mobile health, abbreviated as mHealth) is still sparse.

This technical brief summarises a mobile health intervention research in Bombali district, in north-west Sierra Leone. It describes how health providers were connected to clients through mobile telephones (the interventions), and the assessment of these interventions (the findings regarding results and impact). This technical brief provides recommendations for healthcare providers and policy-makers interested in adopting mobile health interventions to advance maternal and newborn health.

This study was funded by the UK Department for International Development (DFID), as part of the New and Emerging Technologies Research Competition. The study was conducted in 2012-13 by a consortium of partners: the Government of Sierra Leone, the Medical Research Centre, the University of Sierra Leone, the Royal Tropical Institute (KIT), Text to Change, and MannionDaniels.

# mHealth interventions

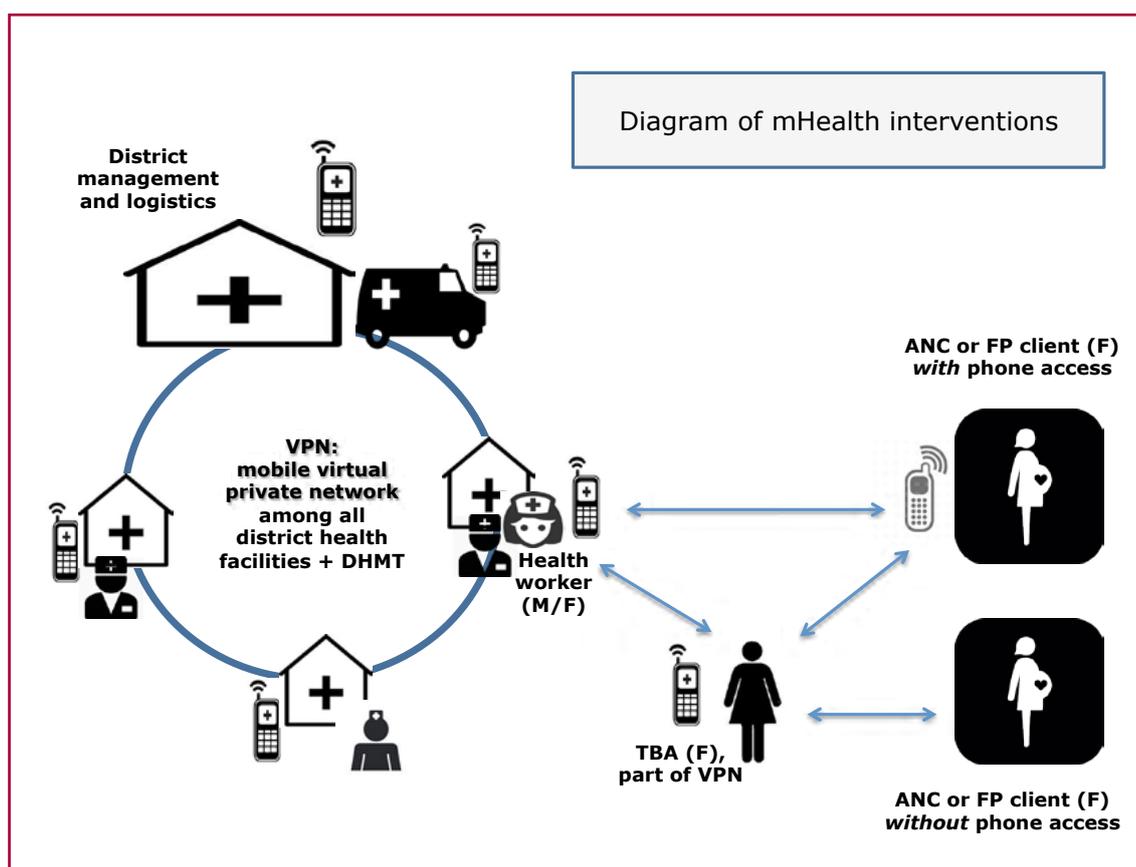
## WHAT WAS THE OBJECTIVE OF THE INTERVENTION STUDY?

The objective of the study was to assess the effect of integrating mobile communication strategies, as part of existing health service packages, on maternal and newborn health service utilization in one health district, Bombali, in Sierra Leone. Specific research objectives were: (i) to assess changes in utilization of MNH services, including family planning (FP), associated with expanded options for client-initiated and provider-initiated mobile communication; (ii) to assess changes in health workers' job satisfaction and control at work, and other self-reported changes due to expanded options for provider-provider communication and provider-client communication; (iii) to assess changes in MNH referral systems due to expanded mobile communication options; (iv) to assess changes in maternal death reporting; (v) to identify implications for the health system of mobile communication initiatives; and (vi) to make policy recommendations for the integration of mobile communication initiatives in district-level MNH service packages.

## WHAT WERE THE INTERVENTIONS?

The approach was selected based on findings from a feasibility study in 2011. A virtual private network (VPN, also known as a 'closed user group') facilitated health worker to health worker communication by providing free calls and text messages between them. All 98 peripheral health units (PHUs) and contacts at health district level received a mobile phone and SIM cards. This was carried out in collaboration with Airtel (one of the four mobile phone network providers in Sierra Leone) as it had the best network coverage across Bombali district. Intervention two consisted of distributing pre-paid phone credit to facilities to allow health workers to call clients and remind them of appointments. This was complemented with appropriate training on how and why to use the telephones. Solar-powered battery chargers provided to PHUs and TBAs made up intervention three; this distribution of chargers was later abandoned because the chargers were of low quality and ineffective. The fourth intervention consisted of engaging traditional birth attendants (TBAs) by providing them with mobile phones and access to the VPN. The TBAs received a similar training as the health workers, and in addition addressed their role in identifying new clients for antenatal care (ANC) or family planning (FP), following up existing clients and their use of phones to communicate with PHUs, especially for referral purposes.

Figure 1: Diagram of mHealth interventions in Bombali district



## HOW WERE THE INTERVENTIONS IMPLEMENTED?

To compare interventions, the study implemented a ‘step-wedge’ approach. The interventions were implemented over a 12-month period (two stages of six months each), and were separated into two ‘wedges’ of six chiefdoms each. Altogether they covered 12 out of 13 chiefdoms of Bombali district. As Table 1 below shows, the VPN was implemented in both wedges from the start. Wedges one and two differed because the other three interventions were only introduced in the second stage for Wedge one chiefdoms. Intervention three (solar powered battery charger) was ultimately not implemented in Wedge two at all as planned due to high rates of malfunctioning.

**Table 1: Overview of staged interventions in Bombali district**

		<i>Intervention 1:</i> Virtual private network: free calls and text messages between health workers	<i>Intervention 2:</i> Health worker to client communication	<i>Intervention 3:</i> Solar-powered battery charger	<i>Intervention 4:</i> TBA involvement
Wedge 1 (6 chiefdoms)	Stage 1	√	√	√	√
	Stage 2	√	√	√	√
Wedge 2 (6 chiefdoms)	Stage 1	√	-	-	-
	Stage 2	√	√	(-)	√

## HOW WERE THE DATA COLLECTED?

Data were collected at three points in time (baseline, midline and endline of the study period August 2012-July 2013). Data were collected using mixed methods consisting of both quantitative and qualitative tools. Table 2 below summarises how data were collected. The data collected present interesting findings and relevant conclusions and recommendations. These should be read with the study limitations in mind, such as the intervention study being carried out over a short period of time (two stages of six months each). Analysis of the facility-based data was limited because of the lack of routine data from the health management information system for the last month of the Stage one Intervention period as well as all six months of Stage two. The TBA interventions were only implemented in two chiefdoms, so effectively consisted of a small pilot study – 34 TBAs in Stage one, and an additional 48 TBAs in Stage two. Although the study was set up in a quasi-experimental design with interventions phased over time and across wedges, there were other non-study interventions and circumstances that could have affected the results (including discouragement of home births, and distribution of free food to pregnant women, lactating mothers and children).

**Table 2: Mixed methods for data collection**

<b>Quantitative data</b> <i>All chiefdoms</i>	<b>Qualitative data</b> <i>2 chiefdoms at Wedge 1 (midline and endline)</i> <i>2 chiefdoms in Wedge 2 (endline)</i>
Baseline survey of 98 facilities on facility characteristics and staffing	101 semi-structured interviews with enrolled clients, male partners, TBAs, health workers and health managers
Surveys in all chiefdoms - at baseline, midline and endline – on background information on Intervention 1 (VPN) and one of the outcomes (health worker job satisfaction). Total of 542 completed health worker questionnaires	8 focus group discussions with 106 female and male community members
	Summary information from maternal death reports
	Summary information from monthly PHU reports on mHealth enrolment and follow-up

# Key findings

## [1] USING MATERNAL AND NEWBORN HEALTH SERVICES

**IF HEALTH PROVIDERS ARE GIVEN THE MEANS TO COMMUNICATE WITH CLIENTS, THEY WILL:** When facility phones and credit were made accessible, there was increased communication via mobile phones between health workers and clients. There was also a significant decrease in health workers who reported ‘never initiating’ mobile communication with clients. The main reasons to communicate were: to arrange appointments, to provide health information, and to inquire about clients’ health status. Other reasons for health workers calling clients included reminders about appointments, informing clients about outreach services and drugs/supplies arrival.

**CLIENTS’ USE OF MOST MATERNAL AND NEWBORN HEALTH SERVICES INCREASED:** There was an increase in use of services at facilities for most of the key selected indicators. Most notably, there were more clients who came for a first and fourth ante-natal care visit, for skilled delivery at the health facility, for post-natal care visits, and to initiate family planning. This was confirmed by analysis of quantitative data available from facilities. This was made possible because the study design allowed for comparison of a counterfactual non-intervention situation with interventions in the comparable wedge, as illustrated in Figure 2. This shows how facility deliveries, one of the key coverage indicators, increased in Wedge one over the period of intervention at a higher rate than in Wedge two, an increase that is directly attributable to the intervention. This is called the double difference analysis: comparing change over time in the intervention situation (Wedge one) with that in the non-intervention situation (Wedge two).

The qualitative data confirmed this finding, showing a perceived increase in utilization of reproductive

health services, that was linked to the increase in health worker-client communication.

In addition, three of the ten service utilization indicators (second and third ante-natal care visits, and continued family planning visits) showed a decreasing trend during the intervention period. One theory is that this could actually be due to an increase in outreach services rather than facility visits over the period of the intervention.

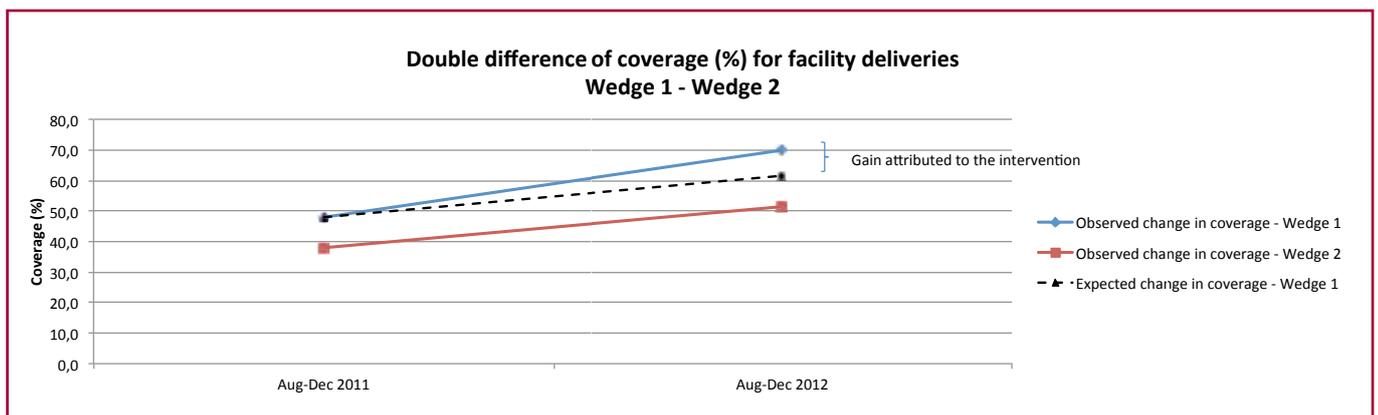
**INVOLVING TBAS IN THE COMMUNICATION LOOP PRODUCED MIXED RESULTS:** Within the global health arena, the debate regarding TBAs continues. In many countries, this discussion has shifted to the changing role of TBAs as health promoters and motivators in connecting female community members to essential reproductive and maternal health services. One of the seminal studies on maternal health and mobile communication work in Indonesia showed that involving TBAs enabled them to better respond to client needs due to improved access to relevant information (Chib et al 2008). This shift was the context for including a specific TBA component in the Sierra Leone research.

When comparing service coverage utilization data, the chiefdom with TBA intervention saw a positive effect on clients using services for family planning. This was both for new FP clients (considerable increase) and for continuing clients (moderate increase). Although no positive effect of the TBA intervention was seen for other service coverage indicators, qualitative data suggests that TBAs played an important role in connecting clients with services.

A decrease in communication episodes between health workers and TBAs was observed. The introduction of the VPN and client communication scheme might have taken attention away from

“Before I did not care for the clinic much, but the reminder phone has helped me to come to the clinic, because the nurse calls me always to remind me.”  
*(Family planning client, endline)*

Figure 2: Net effect on mHealth interventions on coverage for facility deliveries



maintaining communication with TBAs. Data also indicated that some TBAs struggled to use the telephone despite training, and as the solar chargers proved faulty their telephones were not always on. The remote locations where TBAs were living also suffered from intermittent mobile network coverage, thus further complicating the use of telephones. When TBAs got in touch with health providers, it was to inform health workers about referrals to the clinic and discuss client mobilization. Health workers initiated communication to reach clients, inform TBAs about meetings, and ask them to help out at the clinic.

**THERE WERE OTHER PERCEIVED BENEFITS OF COMMUNICATING VIA TELEPHONE:**

When asked about the mHealth intervention programme, respondents reported an increase in services utilization because

clients knew more about staff availability, had developed a better and more trusting relationship with health providers, and had an improved understanding of the need for services. These benefits were also seen to extend beyond the clients enrolled in the study into the community at large.

**SOME SENSITIVE ISSUES TO CONSIDER:**

Mobile phone communication raised a number of sensitive gender issues that need to be taken into consideration. Some female clients voiced discomfort using a communal or family phone because of privacy issues – they did not want other people to be the go-between for their private health matters. Some respondents described how their husbands were uncomfortable with their wives receiving calls

from health workers, and needed proof that it was from a health worker and ‘not another man’. Family planning was specifically seen as a sensitive topic for third party telephone calls and this should be considered in similar interventions in resource-poor countries like Sierra Leone where mobile telephones are often a shared commodity. In this study, almost two thirds of the clients reported using a phone not owned by themselves: husband’s phone 17%, family-owned phone 24% and community owned phone 23%. The willingness of clients to enroll in the client reminder scheme was clearly influenced by empowerment and confidentiality issues, and more so for FP clients as opposed to ANC clients. Nevertheless a large number of clients felt comfortable being enrolled in the study and a number of men explicitly supported this. Many health workers also reported actively engaging with husbands of enrolled clients on the phone, to further maintain and augment their support. In conclusion, any mHealth intervention needs to consider sensitive issues. When dealt with

respectfully, these issues can be further implemented with success.

**MOBILE PHONE USERS PREFERRED CALLING TO TEXTING:**

Although SMS texting is less expensive, voice calling was preferred by both health workers and clients, because this method guaranteed that the message was received and implied ‘direct’ contact.

**REFERRAL WAS STRENGTHENED:**

Access to ambulance services increased with the use of mobile phones, as the quote below clearly illustrates. Qualitative data also indicated that ambulance referral efforts may have become more timely and appropriate, as health workers reported having pre-referral consultations with colleagues in which decisions are made collaboratively. There was a significantly higher percentage of respondents making calls and texts from PHUs to the district level for ambulance referral purposes in Wedge one than in Wedge two at all three time points.

“There was a time when I had a case of obstructed labour here, so I called the nearest hospital at Kamakwie. They came with the ambulance and collected the woman, and she was rescued. But in the past to even get a bike to transport the patient you want to refer was a problem. But through the help of the mobile phone, we can call the hospital quickly for the ambulance, and they will come to rescue the person. That is the difference.”

*(Health worker, endline)*

**THERE WAS BETTER REPORTING OF MATERNAL DEATHS:**

The number of maternal death notifications to the District Health Management Team tripled between baseline and midline. It is known that maternal deaths are grossly under-reported in Bombali district, so the increased reporting most likely is a result of improved reporting and not due to an actual increase in maternal deaths. Qualitative data findings supported this assumption.

**[2] HEALTH WORKER JOB SATISFACTION AND COMMUNICATION**

**USING A PHONE SYSTEM - WITHOUT TIME RESTRICTIONS OR COSTS - WAS A MAJOR ADVANTAGE:**

Having a VPN encouraged health workers to call their peers and seniors more often, and for longer periods of time. Consultations focused on receiving clinical advice and ambulance referral. These reasons contribute to timely and correct referral, and therefore are instrumental in improving quality of care. Another major reason for communication was to facilitate coordination and logistics. Health providers called each other to inform and update about meetings, training workshops, programme activities and about supply chain management and disease surveillance.

“Most women now come to the clinic because of the way the nurses call them and talk to them. The women therefore go and tell other women, and that information which goes round has helped more women come to join the reminder scheme.”

*(Family planning client, endline)*

“There is unity now between [us] and them, which shows that we care for them. They too care for us. When you fail to call somebody that shows that you are not interested in the person. But because we are trying to reduce this infant mortality rate, the phone has helped us greatly.”

*(Health worker, endline)*

## THERE SEEMS TO BE AN IMPROVEMENT IN HEALTH WORKERS' PERCEIVED JOB SATISFACTION:

The study investigated only the domains of job satisfaction linked to the mobile communication intervention (i.e. not other domains such as remuneration or career advancement), and there was already a high level of job satisfaction at baseline that increased over time. Although attribution could not be proven due to the study design, the mHealth package of interventions and communication with peers and seniors seem to have resulted in an overall improvement in the perceptions of health workers regarding job satisfaction and quality of working life. TBAs voiced an increase in satisfaction with their activities due to phone ownership that in turn increased their status within the community. They were seen by the community as part of the health system linked to the facility.

## HEALTH WORKERS DID NOT COMPLAIN ABOUT AN INCREASED WORKLOAD:

The potential challenge of introducing a new manner of working is that it will burden an already over-worked health provider. However, health workers indicated that the increase in service usage by clients, and improved relationships with clients, were both positive developments and worthwhile consequences of an increase in workload. They also saw the increased workload as part of their job. It is possible that this is a short-term finding and that they will become de-motivated if mobile communication interventions become part of every task. TBAs expressed more varied responses regarding workload. Some felt the workload was more efficient (because they did not need to physically travel back and forth to facilities); others experienced an increase in workload.

"It has... increased work for me. I can be doing one thing, and they call me for another. Even as you are talking to me, they are calling me for an emergency. (...) Well it doesn't disturb me as such, because it is part of my work. It only disturbed me a little when I was treating [an] emergency out there."

(Health worker, *endline*)

Improved communication was seen as beneficial to health providers' working relationships contributing to better quality of care. Data from health managers, health providers and TBAs indicated that improved communication led to life-saving referral in the chain of events during emergencies as a result of relationships of trust established by the increase in communication that took place prior to the emergency event. Health workers in particular noted that TBAs were calling them about difficult maternity cases in the community.

## HEALTH SYSTEM IMPLICATIONS

The study findings point to a number of issues related to the health system, which should be taken into account when considering adopting or scaling up mHealth interventions. Among these are the following, discussed for each of the health system building blocks stipulated by the World Health Organization (WHO).

**Service delivery:** Improving service utilization involved not only the 'static' clinic services but also an emerging alternative of 'mobile' consultation. This may require reflection on the implications for provider-client interaction. Also, services would need to be prepared for an increase in demand, not only in terms of workload but also equipment and the drugs and supply chain.

**Workforce:** Various mHealth interventions have different costs and benefits. Introducing an easy way to call colleagues such as the VPN may bring important efficiency gains against little effort, while a client communication strategy based on health workers calling clients places other demands on the time and management capacity of staff. The same type of issues would then also influence job satisfaction and motivation.

**Information:** Delivering information is a key potential of mobile applications. There was a strong preference for direct communication (calling), as opposed to text messaging, to ensure better understanding and not exclude communication with illiterate clients and illiterate community health workers. A further shift towards texting instead of calling is likely, to improve efficiency in communication; it should, however, address the identified disadvantages of texting and consider the inclusion of pictorial or audio elements.



**Equipment and technology:** The interaction of certain mHealth strategies and application with certain health system building blocks demands thinking through a number of issues related to equipment and technology, from choice of phone, alternative charging options and network coverage to issues not tested in the study such as choice of applications, privacy protection and interoperability (across different network providers).

**Governance:** Given the issues at stake, there may be a need for an mHealth regulatory framework that would address legal and ethical issues, public-private partnerships, affordability and sustainability, among others. Another governance-related aspect would be how to use mobile communication to improve the accountability of services to the community and to improve community empowerment and voice.

**Equity:** It is important to reflect on the groups that should benefit from an mHealth intervention already at the design stage. Our intervention sought to engage those most in need with the health services and to make the services more responsive. However, those most in need in terms of maternal and newborn health services are likely to be the poorest, those with least education and awareness and those living in rural and more remote areas. Each of these characteristics might constitute a barrier to participating in a programme aimed at involving precisely such disadvantaged groups. Ways need to be found to make mHealth programmes more inclusive, such as the inclusion of community health workers as go-betweens, so that also clients without access to a phone could participate. In the end, the aim is to reduce, not to widen, the 'information, technology and service gap' between those who can afford to access these services and those who cannot.

## ISSUES AND RECOMMENDATIONS

In the real world of limited resources, decision-makers have to weigh up the evidence on what works and for how much before implementing, and scaling up, health interventions. This study provides useful evidence on the following issues:

- › Increased communication between health workers and clients improves the relationships between them, and can improve service utilization for maternal and newborn health. Preliminary quantitative and qualitative analysis suggests this, and that it is best to establish a mechanism for low- or no-cost calling.
- › Health workers seemed to have improved job satisfaction because of being able to communicate freely with peers and clients. This was despite an increased workload, although whether this would remain the case in a more long-term intervention would need to be examined.
- › Enabling health workers to talk to each other, and to TBAs, improves the accessibility and efficiency of referral. Including ambulance drivers in the VPN network appears to have shortened the time needed for referral pick-up.
- › Involving TBAs is a useful link to the community, and generally appreciated by all involved. But evidence also showed that TBAs have to be carefully trained and supervised.
- › The use of mobile telephones is still limited by technical issues. Most notably, network coverage needs to be extended to ensure the most remote communities become accessible, and phone charging solutions need to be found for locations with poor electricity supply.
- › The implementation of mHealth interventions needs to be accompanied by adequate training, to address initial and ongoing problems in phone handling, sim registration for the VPN, and phone credit.
- › Clients are generally positive about client reminder schemes, but have identified sensitive issues related to certain topics and confidentiality. Both clients and health workers preferred calls to texts. Both these findings have implications for any automated text reminder scheme that might be considered.
- › Health information was appreciated by health workers and clients, but more work needs to be done to examine specific health promotion topics, gaps in information, and client queries.

## REFERENCES

Chib A, Lwina MO, Anga J, Lina H and Santosoa F (2008), *Midwives and mobiles: using ICTs to improve healthcare in Aceh Besar, Indonesia*. Asian Journal of Communication 18(4).

**PHOTOS** by Medical Research Centre (MRC) and KIT. Cover photo: clients queueing at health facility. Other photos: traditional birth attendants showing their mobile phones (and one solar charger).

## FOR THE FULL REPORT AND PRIOR FEASIBILITY STUDY, SEE:

Jalloh-Vos H, Ormel H, De Koning K, et al. (2014), *Mobile health: Connecting managers, service providers and clients in Bombali district, Sierra Leone. mHealth for maternal and newborn health in resource-poor community and health system settings, Sierra Leone. Final report*. Amsterdam: KIT.

Magbity E, Ormel H, Jalloh-Vos H, et al. (2011), *"I expect the health worker to call me". mHealth for maternal and newborn health in resource-poor community and health systems settings, Sierra Leone. Feasibility study report. DFID New and Emerging Technologies Research Competition, Phase I*. Amsterdam: Royal Tropical Institute.

## FOR FURTHER INFORMATION, PLEASE CONTACT:

### Medical Research Centre (MRC)

Dr Heidi Jalloh-Vos  
5 Frazier Davies Drive  
Freetown  
Sierra Leone  
Tel +232 76 684 337  
E-mail [hjallohvos@mrc-sl.org](mailto:hjallohvos@mrc-sl.org)

### Royal Tropical Institute (KIT)

Mr Hermen Ormel  
Senior Advisor  
PO Box 95001, 1090 HA Amsterdam  
The Netherlands  
Tel +31 20 568 8578  
E-mail [h.ormel@kit.nl](mailto:h.ormel@kit.nl), [www.kit.nl](http://www.kit.nl)

This is an open access publication permitting unrestricted use, distribution and reproduction in any medium, provided the original author and source are credited.

This publication was made possible thanks to the financial support of the UK Department for International Development (DFID) under its New and Emerging Technologies Research Competition, Phase 2, with co-funding from the Public Private Partnerships Sierra Leone programme within MDG5 Meshwork.

Disclaimer: this document is an output from a project funded by DFID for the benefit of developing countries. However, the views expressed and information contained in the report are not necessarily those of, or endorsed by, DFID, which can accept no responsibility for such views or information or for any reliance placed on them.

